Appendix J

Recommended Laboratory Standard Operating Procedures And Other Resource Information

Suggested Outline for Your
Laboratory-Specific Chemical Care and Handling Plan

Procedures and protocols for each individual laboratory or group of laboratories should be developed to handle potential emergency situations. Standard operating procedures (SOP) for using specific chemicals or apparatus that could cause injury should also be developed. This appendix will provide guidance as to what procedures or protocols should be developed and what information should be contained within the procedures or protocols. The SOPs or protocols should be brief and to the point. If it is too lengthy, it will not be read. Example: procedures and protocols provided in this appendix can be modified specifically for your facility or used directly as written.

I. Safety procedures and protocols

A. Notification protocol

1. This procedure should include:

a. names of all personnel to be notified in the event of an emergency.
b. how these people are to be notified (i.e., telephone, loud speaker, etc.)
c. a list of all of areas in the building for which you are responsible.
d. a system for notifying people who might be in remote locations in the building (i.e., cold rooms, environmental chambers, darkrooms, etc.) in the event that the entire building is being evacuated.
e. information on the types of signs that should be posted.
f. where they will be posted in the event there is an emergency in a particular area and to keep people from returning to the area.

2. Refer to the notification procedure example given at the end of this Appendix.

B. Chemical spill clean-up procedure

1. This procedure should include:

a. a detailed description of the storage location and the contents of your labs chemical spill clean-up kit.
b. instructions on the clean-up and disposal of any type of chemical spill that might occur in the lab.
c. instructions of what to do when a spill is beyond the capabilities of the laboratory personnel.

2. Refer to the chemical spill procedure and chemical spill clean-up kit examples given at the end of this Appendix.

C. Personal protective equipment (PPE) safety

1. This procedure should include:

a. the specific types of PPE that should be utilized for each group of chemicals in the laboratory.
b. the specific types of PPE that should be utilized for individual chemicals that are being used in bulk or that have particularly hazardous properties.
c. proper use, cleaning and decontamination of PPE.
d. proper storage of the PPE.
e. inspecting PPE.
f. procuring new PPE.

2. Refer to the eye wear procedure example given at the end of this Appendix.

D. Fume hood use

1. This protocol should include:

a. the type(s) of fume hoods present in the laboratory
b. proper use of the hood(s).
c. materials that are acceptable for use within the hood(s).
d. acceptable and unacceptable operations that may be performed in the hood.
e. specific, step by step procedures for the use of perchloric acid hoods and wash down systems.

2. Refer to the chemical fume hood operating procedure example given at the end of this Appendix.

E. Fire Procedures

1. This protocol should include:

a. what to do if you discover a fire.
b. what to do in the event of a fire alarm.
c. how and when to use a fire extinguisher.
d. how to exit the building from a given laboratory.

2. Refer to the portable fire extinguisher operating procedure and fire protocol examples given at the end of this Appendix.

II. Personal injury procedures

A. Eye injury (eye wash station)

1. This procedure should include:

    a. where the eyewash is located.
    b. how to use the eyewash.
    c. emergency notifications.
    d. first aid procedures.
    e. reporting the incident.
    f. special considerations concerning chemicals of extreme hazard.

2. Refer to the emergency eyewash standard operating procedure example given at the end of this Appendix.

B. Skin injury (safety shower)

1. This procedure should include:

    a. where the safety shower is located.
    b. how to use the safety shower.
    c. emergency notifications.
    d. first aid procedures.
    e. reporting the incident.
    f. special considerations concerning chemicals of extreme hazard.

2. Refer to the safety shower standard operating procedure example given at the end of this Appendix.

C. Respiratory injury

1. This procedure should include:

    a. immediate actions to be taken (i.e., first aid).
    b. emergency notifications.
    c. procedures for medical transportation.
    d. reporting the incident.
    e. special considerations concerning chemicals of extreme hazard.

2. Refer to the respiratory injury procedure example given at the end of this Appendix.

D. Ingestion of hazardous chemicals

1. This procedure should include:

    a. immediate actions to be taken (i.e., first aid).
    b. emergency notifications.
    c. procedures for medical transportation.
    d. reporting the incident.

e. special considerations concerning chemicals of extreme hazard.

2. Refer to the ingestion procedure example given at the end of this Appendix.

III. Chemical storage plan

A. The chemical storage plan should address classes of chemicals and specific, high hazard chemicals used in the laboratory. The storage plan should include:

1. storage locations of chemicals by group.
2. color coding on labels used to identify compatible storage.
3. alphabetizing chemicals within compatible groups.
4. protection of shelving and storage cabinets.
5. special storage considerations regarding high hazard chemicals.
6. storage location for chemical waste.

B. Refer to the chemical storage plan for laboratories example given at the end of this Appendix.

IV. Chemical waste disposal

Refer to Appendix G

V. Lab apparatus protocols and operating procedures

Make manufacturers equipment manuals available to employees.

VI. Particularly hazardous substances

Information regarding the step by step procedures for handling particular hazardous substances can be obtained from the manufacturer, the MSDS, or reference literature. The perchloric acid protocol given on the next page is provided as an example.

WORK AREA NOTIFICATION PROTOCOL

In the event of an emergency that results in serious injury to laboratory staff, damage to property, or serious disruption of laboratory operations, follow emergency notifications and response, and initiate notification of laboratory personnel and management.

Emergency Notifications:

_____	_____	_____
principal researcher	office	home
_____	_____	_____
laboratory manager	office	home
_____	_____	_____
department head	office	home

Notification of personnel outside the laboratory:

Post a sign on all entrance doors to the laboratory where the spill occurred indicating:

Do Not Enter - Hazardous Chemical Spill

For more information call _____ at _____
your name phone # you will be at

In the event of a building evacuation:

Notify all personnel in rooms_____
of the evacuation on your way out.

Contact (_____) at (_____) or (_____)
principal researcher office home

Contact (_____) at (_____) or (_____)
laboratory manager office home

HOW TO PROPERLY COMPLETE A CAUTION SIGN

In order to bring greater uniformity to safety signs throughout the University and to reduce clutter on laboratory doors and hallways, the University of Georgia provides all laboratories with door caution signs. All standard safety warnings are concentrated on one 8.5 x 11 inch yellow and black caution placard. These placards should be posted on all laboratory entrances and in lab service areas where hazardous materials are used or stored. Lab door caution signs may be requested free of charge from ESD at 2-5801.

MARKING THE SIGN

The caution signs will be laminated when received. Use a fine point permanent marker, such as a Sharpie, to mark hazards, degree of hazard, quantities, contact information, date posted, etc. When the information on the sign needs updating, use isopropyl alcohol to erase the old information. DO NOT destroy or dispose of the sign. These placards are meant to be reused. If the lab is to be closed, please return the sign to ESD for reissue to another lab.

HAZARDS SECTION

The Hazards section of the door caution sign is divided into Primary and Specific Hazards and is used to indicate that a chemical hazard with a degree of hazard 1 through 4 (see definitions below under the NFPA Diamond section) is present in the laboratory. Each hazard is listed by type (health, flammable, reactive or biohazard). Place a dark check mark in the appropriate box to the left of the hazard symbol to indicate that a hazard is present. Next, indicate the quantity of the hazard present by listing the approximate amount in the space provided to the right of the hazard symbol. An exact amount is not required and quantities may be estimated. For example, acetone is used in the lab and is ordered in a 20 liter container. Acetone is a flammable hazard 3, so a check mark is placed in the box to the left of the flammable symbol. In the space to the right of the symbol place the quantity normally found in the lab; i.e., 20 liters.

The degree of hazard for many commonly used lab chemicals can be found on the manufacturer's label, on the material safety data sheet (MSDS), in the manufacturer's catalog or at http://esd.uga.edu/chemical-lab-safety/right-know/msds-access. Each substance is rated on a scale of 0 (non-hazardous) to 4 (extremely hazardous) for each category:

- **Health Hazard -** the danger or toxic effect of a substance if inhaled, ingested or absorbed.
- **Flammable Hazard** - the tendency of the substance to burn.
- **Reactive Hazard** - the potential of a substance to explode or react violently with air, water or other substances.

If your laboratory employs biohazard materials, the appropriate safety level must be placed in the space provided to the right of the biohazard symbol. Please call the biosafety office at 2-7265 to have the biosafety level in your laboratory assessed.

- **Biohazard -** the biosafety level assigned by the biosafety officer/committee.

Check the box to the left of each Specific Hazard (contact, compressed gas cylinder,

air/water reactive or ultraviolet light) and indicate the quantity of the hazard present. The contact hazard box would be checked if the substance presents a danger when exposed to skin, eyes or mucous membranes. If compressed gas cylinders are present, check the box to the left and indicate the number of cylinders by product in the space to the right of the hazard symbol. For example, three cylinders of carbon dioxide would be written as CO_2 - 3.

If your laboratory employs radioisotopes, all radioisotopes listed on the laboratory license must also be listed in the space entitled "Other Hazards" on the caution sign. Additionally, a rad sticker must be placed on the door sign in the space provided to the right of the white hazard boxes. Please call ESD at 542-5801 to obtain a rad sticker.

THE NFPA DIAMOND

The NFPA (National Fire Protection Association) diamond, located on the right hand side of the door caution sign, is used to record the Degree of Hazard (0 - 4)of all hazardous substances in the lab. The diamond gives a quick visual determination of the highest level of hazards present in a given laboratory. The NFPA diamond is divided into four sections with the following designations:

Blue	- Health rating
Red	- Flammability rating
Yellow	- Reactivity rating
White	- Special warnings such as air or water reactive substances.

Each of the first three sections should be filled in with a number from 0 to 4 to indicate the highest level of hazard found in your lab. For instance, if the most flammable substance in your laboratory has an NFPA flammability rating of 3, a large 3 should be placed in the red box of the NFPA diamond. If the most reactive substance in your lab has a rating of 2, a large 2 should be placed in the yellow reactivity box. Many reagent bottles labels contain NFPA diamonds indicating the associated hazards. In this instance, NFPA ratings are easily determined. If the ratings are not on the bottle, consult material safety data sheets (MSDS) or NFPA rating charts to get the appropriate ratings. Also, see http://esd.uga.edu/chemical-lab-safety/right-know/msds-access for NFPA listings of many chemicals commonly found in the laboratory. The level of hazard associated with each numerical rating is found below:

Health (Blue)	**Flammability (Red)**	**Reactivity (Yellow)**
0 - Normal Material	0 - Will not burn	0 - Stable
1 - Slightly Hazardous	1 - Flash Point above 200 F	1 - Unstable if heated
2 - Hazardous	2 - FP between 100 & 200 F	2 - Violent change
3 - Extreme danger	3 - FP below 100 F	3 - Shock and heat may detonate
4 - Deadly	4 - FP below 73 F	4 - May detonate

The white section or "Special Warnings" would contain the symbol ~~**A, W**~~ **or OX** indicating that air or water reactive or oxidizing chemicals are present in the laboratory.

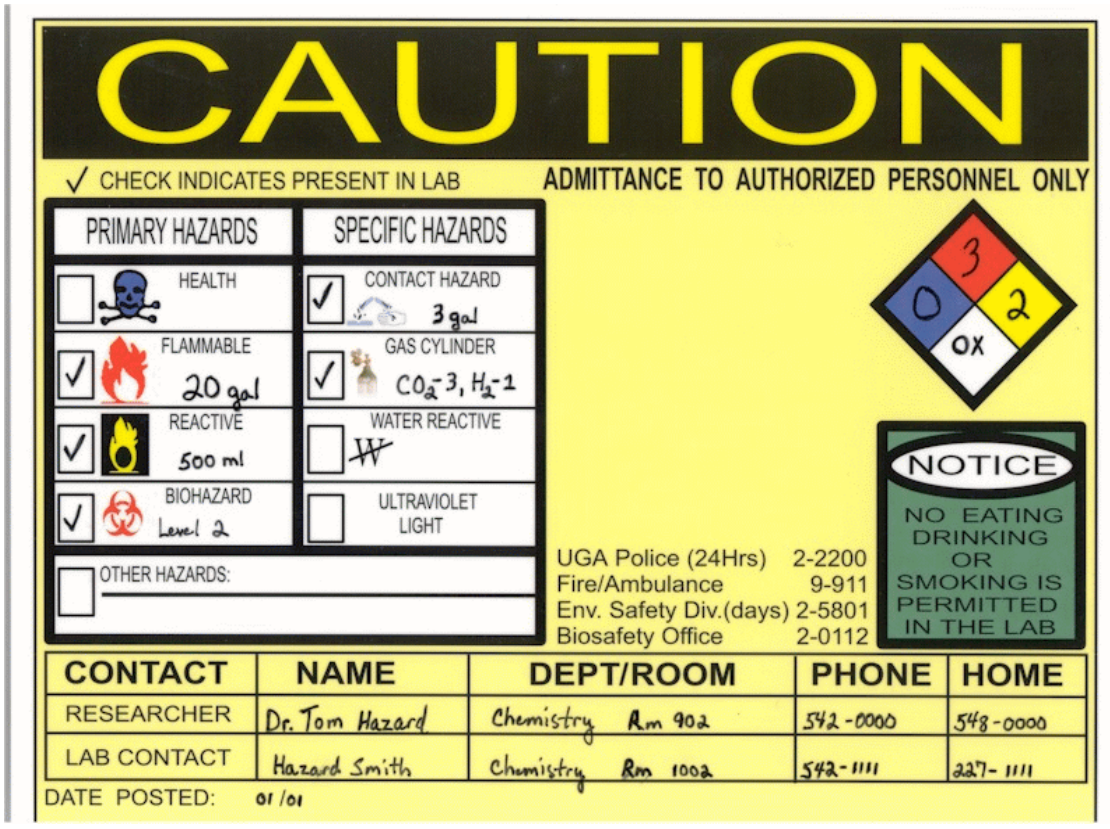
CONTACT INFORMATION

In this section, list two people that may be contacted in case of an emergency in the laboratory. The first name recorded should be that of the professor who is the primary researcher for the laboratory. His/her department, office room number, office phone number and home phone number should be recorded. A second name (usually the laboratory supervisor) should be listed in the same manner in the event that the primary researcher cannot be contacted during an emergency. The second person listed should be someone who regularly works in the laboratory and can make responsible decisions in the event of an emergency. DO NOT record the telephone number of ESD, UGA Police Department or 9-911 in this space.

DATE POSTED

Place the month followed by the year that the sign is posted to the right of this field. The placard and its contents should be reviewed annually. If any changes are made during the year, the sign should be updated to indicate current laboratory conditions. The date that the sign was updated should be indicated in the date posted section by placing the corresponding month followed by the year.

All information contained on the caution sign is helpful to emergency personnel responding to a reported fire, spill or injury in the lab. An example of a caution sign that is properly filled out is given below. If you have any questions concerning your caution sign, please call ESD at 2-5801.



Chemical Spill Procedure

- Do not attempt to clean up any spill if
  - the appropriate PPE is not available.
  - appropriate spill clean-up materials are unavailable.
  - the chemical or level of exposure hazard is unknown.
  - you have not been appropriately trained in chemical spill clean up.
  - you do not have and/or have not been trained to use respiratory protection devices.
  - the chemical is of extreme hazard. (NFPA 49 in any section)

    If you need assistance contact ESD at 2-5801

- General procedures
  - **Get away**. Avoid contact with the chemical(s). Evacuate the area if there is an immediate risk to occupants. Turn on exhaust ventilation (fume hood/emergency exhaust) and, if flammables are involved, eliminate sources of ignition and flames.
  - **Identify the chemical.** Know the chemical name(s), state and concentrations.
  - **Get help.** Call ESD at 2-5801. If the emergency involves fire, also call 9-911.
  - **Seal off the area and alert others.** Notify anyone in surrounding areas who may be affected by the spill. Keep anyone from entering the affected area.
  - **Look for injuries**. If any injury involves chemical contact, immediately disrobe the affected areas and wash continuously (follow safety shower or eyewash SOP). Notify the University Police at 2-2200 of the need for emergency personnel. Await instructions from emergency response personnel.
  - **Initiate work area notification procedures.**
- Solvent spills
  - Don protective gloves (list gloves appropriate for solvents in the laboratory), respirator (if available in the laboratory and if personnel are trained in its use, see Appendix E), safety goggles, and a lab coat.

- Absorb the spill onto universal absorbent pads. If the spill is small enough absorbent paper (note: this does not mean paper towels) may be used. Place absorbent material onto a fiber, glass, or metal tray and place it in the nearest functioning fume hood. ***Contact HMTF at 9-369-5706 for disposal instructions.***

- Acid or base spills

  - Don protective gloves (list glove(s) appropriate for acid available in the laboratory), respirator (if personnel are trained in its use, see Appendix E) , safety goggles, and a lab coat.

  - Use universal absorbent pads to absorb the spill. Place the pad in a container and dispose of through the hazardous material program.

  - If universal absorbent pads are unavailable cover acid contaminated surfaces with sodium bicarbonate or spill kit acid neutralizing material or cover basic spills with a dilute acid solution (vinegar or citric acid) or spill kit base neutralizing material.

  - If universal pads are NOT used, test the spill with pH paper to ensure that it has been completely neutralized. Use available non-combustible absorbent material to absorb the spill (i.e., kitty litter, vermiculite, etc.)

  - Contact HMTF (9-369-5706) to see if the material needs to be disposed of as hazardous waste. Wash the spill area thoroughly.

- Solid spills

  - Don nitrile rubber gloves, safety goggles, and a lab coat. Respiratory protection will be necessary in the event of a large spill release in a confined area, or spill under conditions of higher than normal temperatures. (see Appendix E for respirator use)

  - Sweep into a chemical resistant dust pan or onto paper. Place into a plastic bag or other sealable resistant container. ***Contact HMTF at 9-369-5706 for disposal instructions.***

- Mercury spills

  - Don disposable rubber gloves, safety glasses or goggles, a lab coat and a respirator (if necessary and personnel are trained in its use, see Appendix E).

  - Collect all droplets and pools at once using a commercial mercury spill kit (available through CRS or ESS) or a small aspirator with a capillary tube and connected to a pump that can be used for collecting droplets.

  - Cover fine droplets in non-accessible cracks with calcium polysulfide and excess sulfur. Combine all contaminated mercury in tightly stoppered bottle. Recycle, or dispose of through HMTF.

- Following the spillage of mercury onto a carpeted floor, the area is to be decontaminated using a mercury spill kit. Occupants are not to be allowed onto the contaminated area and the floor is not to be vacuumed until the extent of the spill can be assessed by ESD. In the event of extensive contamination the carpet will have to be removed.

- No mercury or mercury contaminated items shall be discarded into the sewer system or trash. All waste mercury or mercury contaminated items shall be given to HMTF for recycling or disposal.

Developing a General Laboratory Spill Kit

Listed below are the materials necessary to develop a fairly inexpensive general spill kit for your laboratory. Purchasing the bulk of these materials through a hardware or discount store is suggested since it will lessen the expense of the kit. This kit should be able to handle $\leq$ 1 liter of most acids, bases, and solvents found in a typical laboratory. Do not attempt to clean up a spill of greater volume.

Materials:

Large plastic tub to hold the contents of the kit (3-5 gallons)
Plastic dust pan and brush (non-sparking)
Chemical safety goggles and face shield
Appropriate chemical resistant gloves (ex. neoprene)
3-5 waste disposal bags that can be sealed/closed
4-5 absorbent pads
note: brown paper towels and other combustible tissue may ignite when brought into contact with certain chemicals
pH paper
Bleach (if biohazards are present)
Kitty litter for liquid spills
Sodium bicarbonate for acids
Citric acid for bases
"Powersorb Universal Absorbent Pads" (3M) or other "universal" pads
note: we recommend these pads. They may be used for most acids, bases, and solvents found in the lab. They absorb more liquid than kitty liter and therefore produce less waste (~ 5 pads for 1 liter). Place litter or pads in a chemical resistant container and dispose of through HMTF.

Specific Hazardous Chemicals:

This general chemical spill kit is not meant for use with mercury, hydrofluoric acid, sodium metal, cytotoxic drugs, and numerous other chemicals. It is the responsibility of all laboratory personnel to evaluate a potential spill and develop spill response procedures for the specific hazards present. This kit can be modified to meet the needs of your laboratory. Refer to the MSDSs for the chemicals handled in the lab to identify if special spill materials are needed. Contact ESD if you have any questions regarding spill materials for your lab. Any major spill should be reported to ESD at 2-5801.

STANDARD OPERATING PROCEDURES FOR THE SELECTION AND USE OF PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

Industrial grade safety eye wear must be worn at all times when working or observing work procedures in the laboratory. Safety eye wear which is appropriate to the hazard or operation is to be selected using the following criteria:

Safety Glasses

to be used when:

- working with, or observing operations involving, small quantities of non-corrosive, low eye hazard chemicals
- working with, or observing operations involving, low hazard chemicals (no greater than a 2 in any of the NFPA designations)
- working with, or observing operations involving, ultraviolet light
- working with, or observing operations involving, possible flying particles or projectiles.

Safety Goggles

to be used when:

- working with, or observing operations involving, chemicals capable of damaging the eyes
- working with, or observing operations involving, larger quantities of low hazard chemicals (1 gallon or more)
- working with, or observing operations involving, chemicals with an NFPA hazard rating of 3 or 4 in any of the designations.

Face Shields

to be used:

- in place of safety glasses for a larger protection area
- in conjunction with safety goggles when working with large volumes (1 gallon or greater) of corrosive or skin absorbable chemicals.

Protective eye wear is to be near the entrance of the laboratory in an easily accessible location. Inspect all eye wear prior to use. If the eye wear is damaged in any way, bring it to the attention of the supervisor for immediate replacement. Decontaminate and clean eye wear prior to storage after each use.

Chemical Fume Hood Standard Operating Procedure
General Purpose Hoods

Use this type of hood only for the removal of vapors released or generated by chemical reactions involving:

- mildly toxic materials
- acids (not heated)
- organic solvents
- < 10 milliCurie of radioactive materials

In this type of hood, do *not* use:

- hot perchloric acid
- hot concentrated acids
- highly toxic materials
- unstable chemicals or explosives
- > 10 milliCuries of radioisotopes
- perchloric acid if used routinely

If a CAUTION or DANGER sign is posted, do not work in the hood until the face velocity has been adjusted

- Do not use large pieces of equipment in the hood.
- Close doors and windows when hoods are in operation.
- Avoid foot traffic and rapid arm/body movement.
- Place chemical sources and equipment at least 6 inches behind the face of the hood.
- Do not extend your head inside of the hood while experiments are being performed
- Perform work with the sash height as low as possible (at most 10-12 inches).
- Keep fume hoods and adjacent work areas clean since solid debris can enter the hood's exhaust duct work.
- Protect spark sources from flammable vapors. Permanent electrical receptacles are not permitted in the hood.
- Do not cut holes into the hood or its duct work.
- Do not store chemicals in a fume hood unless storage is the sole use of the hood. Only those chemicals necessary to perform the experiment should be left in the hood.
- Do not use hood evaporation as a means of chemical disposal.

IN CASE OF FIRE

If you discover a fire:

1) Activate the fire alarm pull station.

2) Evacuate the building using stairwells and corridors. Close as many doors between you and the fire.

3) From a safe location, call 9-911 and report the fire. Then call 2-2200 (University Police) and report the fire. Initiate your work area notification protocol.

4) Do not reenter the building until the all clear is given by the fire department. A silenced alarm does not indicate an all clear.

If you hear a fire alarm:

1) Proceed to the nearest exit. Evacuate the building using stairwells and corridors. Do not use elevators.

   If the door is closed in the room you are in, do not open the door until you have felt the knob and upper door for heat. If the door or knob are hot, do not open the door. Stuff the door cracks with towels, lab coats, throw rugs, etc. If the window is clear of smoke or flames, open it and hang a lab coat or some other material as a signal to firefighters that you are in the room. If a phone is available and working, call 9-911.

2) If you encounter excessive smoke while evacuating, get as low as possible and crawl to the nearest exit. If possible, cover your mouth and nose with a wet cloth.

3) Once outside, move to a safe location. Do not reenter the building until the all clear is given by the fire department. A silenced alarm does not indicate an all clear.

Portable Fire Extinguisher Standard Operating Procedure

Portable extinguishers are intended as a first line of defense to cope with fires of limited size. The selection, installation, inspection and maintenance are important parameters for acceptable extinguishing equipment. ALL FIRES MUST BE REPORTED TO ESD WITHIN 24 HOURS OF THE FIRE.

SELECTION

The selection of extinguishers for a given situation shall be determined by the character of the anticipated fire.

Class A Extinguishers:

Class A fires are ordinary combustible materials such as wood, cloth and paper. Extinguishers for protecting class A hazards shall be selected from water type and multipurpose dry chemical.

Class B Extinguishers:

Class B fires are in flammable liquids, oils, greases, tars and flammable gases. Extinguishers for the protection of class B hazards shall be selected from aqueous film forming foam, film forming fluoroprotein foam, carbon dioxide, dry chemical types and halogenated agent types.

Class C Extinguishers:

Class C fires involve energized electrical equipment where the electrical non-conductivity of the extinguishing media is of importance. Extinguishers for protection of class C hazards shall be selected from carbon dioxide and dry chemical types.

Class D Extinguishers:

Class D fires involve combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium. Extinguishers for the protection of class D hazards shall be of the types approved for the specific combustible metal hazard.

OPERATION

Extinguishers vary in operation and instructions are required to be in plain view on the front of the extinguisher. The basic steps for actuation should apply to all extinguishers and are as follows:

1. Remove fire extinguisher from its mount.
2. Remove locking device: Extinguishers have a locking safeguard to prevent accidental actuation. These usually consist of lock pins or ring pins and must be removed before actuation.
3. Discharge: These may require one or more of several actions including pushing, pulling, turning, or squeezing a valve handle or lever. Direct the stream of the extinguishing agent toward the base of the fire. Nameplate information has advisory notes regarding the application of the agent to different types of fires.

If there are any additional questions consult the codes and standards of the National Fire Protection Association. If you would like Fire Extinguisher Training, please contact Fire Safety at 369-5706.

Emergency Eyewash Station
Standard Operating Procedure

LOCATION(S):_____

_____

TO USE THE EMERGENCY EYEWASH STATION:

1. Do not panic.
2. Shout out for help to allow co-workers to assist you.
3. Get to the eyewash station and turn the eyewash on.
4. Someone should be calling for EMS. From campus, dial 9-911.
5. Rinse both eyes with copious amounts of water for a minimum of 15 minutes.
6. Keep your eyelids open by using your hands to ensure adequate flushing of the eyes.
7. Continue rinsing eyes until emergency medical personnel arrive to assist.
8. Contact ESD at 2-5801 in the event of an emergency.

Please note: The emergency eyewash station is only for first aid. It is not medical treatment for chemical exposures. Make certain that you seek proper medical attention.

THINGS TO REMEMBER

- Keep the eyewash and safety shower free of obstructions at all times.
- Keep the "pressure pop-off" covers (protective caps) on the eyewash stations.
- Test eyewash stations for approximately five minutes every week.
- Be sure that there are no electrical wires or outlets in the surrounding vicinity and the eyewash station should be easy to reach.
- All personnel should be able to identify the location of the eyewash station before any work begins. Know the location of the eyewash station with your eyes closed.
- Be ready to assist co-workers in the event of an accident.
- Turn off hot water from the main or completely remove the hot water knob for eyewash stations that are mounted to a faucet.

Safety Shower Standard Operating Procedure

LOCATION(S):_____

_____

TO USE AN EMERGENCY SAFETY SHOWER:

1. Do not panic.
2. Shout out for help.
3. Allow co-workers to assist you.
4. Someone should be calling for emergency medical assistance. On campus this may be done by dialing 9-911.
5. Get to the safety shower and pull the shower handle.
6. Begin removing all articles of clothing and jewelry. Modesty is not an issue in a life threatening situation.
7. Rinse with copious amounts of water for a minimum of 15 minutes.
8. Co-workers, assist. The victim may faint, go into shock, or may not wish to stay under the shower due to water coldness or fatigue.
9. Allow emergency medical personnel to help with further assistance.
10. Seek immediate medical attention.

Additional Measures to Consider:

- The safety shower should remain free from obstructions at all times.
- There should be no electrical sockets in the surrounding vicinity and the safety shower should be easy to reach.
- Have all personnel identify the location of the safety shower before any work begins. You should know the location with your eyes closed.
- Be ready to assist co-workers in the event of an accident.
- Decontaminate helpers.
- Discard any clothing that may be contaminated as hazardous waste.
- Contain water flow from showers with absorbent material to prevent the spread of contamination.
- Contact ESD at 2-5801 anytime the safety shower is used.

RESPIRATORY INJURY PROTOCOL

In the event that toxic vapors or large quantities of moderately hazardous vapors are inhaled:

- Remove from exposure area to fresh air immediately.
- If breathing has stopped, give artificial respiration.
- Keep affected person warm and at rest.
- Call University Police at 2-2200 or 9-911 to get assistance.
- Contact ESD at 2-5801 to get an MSDS.
- Remain with the affected person until emergency responders arrive.
- Have a copy of the MSDS sent with emergency responders or to the hospital.
- Fill out two UGA Accident/Incident report forms and two Employer's First Report of Injury forms; forward to human resources.
- Initiate laboratory work area notification procedures.

In the event small quantities of moderately hazardous vapors are inhaled:

- Remove from exposure area to fresh air immediately.
- Contact ESD at 2-5801 to get assistance.
- In a timely manner, seek medical attention.
- Fill out two UGA Accident/Incident report forms and two Employer's First Report of Injury forms; forward two copies to human resources.

HAZARDOUS CHEMICAL INGESTION PROTOCOL

In the event that toxic, corrosive, or moderately hazardous chemicals are ingested:

- Keep affected person warm and at rest.

- Call University Police at 2-2200 or 9-911 to get assistance.

- Contact ESD at 2-5801 to get chemical specific ingestion protocols and an MSDS.

- Remain with the affected person until emergency responders arrive.

- Have the MSDS sent with emergency responders or to the hospital.

- Fill out two UGA Accident/Incident Report and two Employer's First Report of Injury or Occupational Disease forms. Forward to human resources.

- Initiate laboratory work area notification procedures.

Chemical Storage Plan For Laboratories

- Chemicals should be stored according to hazard class (i.e., flammables, oxidizers, toxics, corrosives, etc.)
- Incompatible chemicals should be physically separated from each other during storage.
- Store chemicals away from direct sunlight or localized heat.
- Containers of corrosive chemicals (acids/bases) should be stored in chemical-resistant catch trays large enough to contain any spill or leakage.
- All chemical containers must be labeled in accordance with the Chemical and Laboratory Safety Manual.
- Store **hazardous chemicals** at a safe reachable height for all workers in the laboratory.
- Shelves should be made of chemical resistant materials and/or covered with a chemical resistant coating.
- Shelves should be secure and strong enough to hold chemicals being stored on them. Do not overload shelves.
- Personnel should be aware of the hazards associated with all hazardous materials.
- Separate solids from liquids.

The following are examples of groups of chemicals that can be categorized for chemical storage. Use these groups as examples when separating your chemicals by compatibility. Please note that reactive chemicals must be more closely evaluated since they have a greater potential for reacting with chemicals in their same group. See Appendix D or chemical storage based on color code system. This posting may be posted in storage areas to aid workers in chemical storage. Contact laboratory safety if you have any questions concerning chemical storage.

Acids:

- Make sure that all acids are stored by compatibility.
- Store concentrated acids on lower shelves in chemical-resistant catch trays or in a corrosives cabinet. This will temporarily contain spills or leaks.
- Separate acids from bases and active metals such as sodium, magnesium, and potassium.
- Acids should be separated from chemicals which can generate toxic gases when combined (i.e., sodium cyanide and iron sulfide).

Bases:

- Make sure that all bases are stored by compatibility.
- Store bases away from acids.
- Store concentrated bases on lower shelves in chemical-resistant catch trays or in a corrosives cabinet. This will temporarily contain spills or leaks.

Flammables:

- Make sure that all flammables are stored by compatibility.
- You may store 10 gallons of flammable liquids per 100 sq.ft. of flammable liquids in non-fire separated lab areas (NFPA 30 & 45). Lab areas that are properly fire separated or are sprinkled may store 20 gallons of flammable liquids per 100 sq.ft. in the area. The maximum allowable quantity for flammable liquid storage in any size lab is not to exceed 120 gallons.
- Approved flammable storage cabinets should be used for flammable storage.

Regarding flammable liquid storage outside of approved flammable storage cabinets, there may be a maximum of 10 gallons of flammable liquids in original containers and an additional 25 gallons in approved safety cans not to exceed 2 gallon size (NFPA 45).

- Use only explosion-proof or intrinsically safe refrigerators and freezers for storing flammable liquids.
- University of Georgia guidelines for flammable storage follow NFPA 30 & 45.

Peroxide-Forming Chemicals:

- Make sure that all peroxide-forming chemicals are stored by compatibility.
- Peroxide-forming chemicals should be stored in airtight containers in a dark, cool, and dry place.
- Unstable chemicals such as peroxide-formers must always be labeled with date received, date opened, and disposal/expiration date.
- Peroxide-forming chemicals should be properly disposed of before the date of expected peroxide formation (typically 6 months after opening).
- Suspicion of peroxide contamination should be immediately investigated. Contact ESD at 2-5801 for procedures.

Water-Reactive Chemicals:

- Make sure that all water-reactive chemicals are stored by compatibility.
- Water-reactive chemicals should be stored in a cool, dry place. Do not store water-reactive chemicals under sinks or near water baths.
- Class D fire extinguishers for the specific water-reactive chemical being stored should be made available.

Oxidizers:

- Make sure that all oxidizers are stored by compatibility.
- Store oxidizers away from flammables, combustibles, and reducing agents.

Toxics:

- Make sure that all toxics are stored by compatibility.
- Toxic compounds should be stored according to the nature of the chemical, with appropriate security employed when necessary.
- A poison control network telephone number should be posted in the laboratory where toxics are stored.

Perchloric Acid Standard Operating Procedure

The following is a sample SOP for perchloric acid. This SOP should be placed in the "Particularly Hazardous Substances" section of your Laboratory-Specific Chemical Care & Handling Plan. Please note: this SOP is a general procedure for the use of perchloric acid. It does not address specific issues for each unique operation that may be performed in a lab. Please modify this procedure to meet the needs of your particular situation.

- Procedures and practices
    - Persons working with perchloric acid should be thoroughly familiar with general guidelines for the safe handling of hazardous chemicals supplemented by additional precautions particular for this chemical. Section 2 of the Laboratory Safety Manual covers SOP for general laboratory practices. General safety guidelines include use of the PPE, laboratory apparel, etc.
    - Storage and handling.
        - Perchloric acid should be used only in standard analytical procedures from well recognized analytical texts. Work with > 85% perchloric acid requires special precautions and should be carried out only by specially trained personnel.
        - As a minimum, splash goggles, nitrile gloves, and a lab coat should be worn when handling perchloric acid.
        - Always transfer perchloric acid over a chemical resistant catch tray in order to catch any spills and afford a ready means of disposal.
        - Precautions should be taken to prevent the build up of explosive perchlorates. Light, mechanical shock, heat and certain catalysts can be initiators of explosive reactions with the perchlorates that may be formed from perchloric acid. Anhydrous acid which may be formed with strong dehydrating agents decomposes at ordinary temperatures and explodes on contact with most organic materials. Perchloric acid containers should be kept open no longer than 15 minutes per experiment.
        - Perchloric acid should be stored in well-ventilated location separated from organic substances and other combustible materials. Do not store perchloric acid in a refrigerator or other dehydrating atmosphere.
        - Keep incompatible chemicals away from perchloric acid and the area in which perchloric acid will be used. Those chemicals that are incompatible with perchloric acid include oxidizable organic compounds such as alcohols, ketones, aldehydes, ethers, and dialkyl sulfoxides; strong acids such as sulfuric acid; dehydrating agents; anhydrous phosphorous pentoxide; formaldehyde; antimony or bismuth; and reducing agents. Seventy percent perchloric acid may react with cellulose materials such as wood, paper, and cotton. Preventing contact with

incompatible chemicals during storage may be accomplished by placing perchloric acid containers in nonbreakable, chemical resistant containers which are capable of holding the entire contents of the container.

- Fume hoods
    - General purpose fume hoods

      Heating of perchloric acid or perchloric acid reactions that involve heat shall ***not*** be conducted in a general purpose fume hood. Use of perchloric acid (<72%) at ambient temperature may be conducted in a general purpose fume hood if the following procedures are followed:

        - Only small quantities are used on an infrequent basis.
        - Easily accessible areas in the fume hood, which are exposed to perchloric acid, are immediately wet wiped or rinsed with a squirt bottle of distilled water after use. This procedure prevents the buildup of explosive perchlorates. Periodic methylene blue tests should be conducted after each perchloric acid use for the presence of any perchlorates.

    - Perchloric acid fume hoods: Special precautions involving heated perchloric acid

        - Anhydrous perchloric acid is a powerful oxidizer that may explode if it comes in contact with organic materials. Anhydrous perchloric acid can be produced when heating perchloric acid, during the evaporation of perchloric acid, or during reactions involving dehydrating agents.
        - Chemicals that are incompatible with anhydrous or hot concentrated perchloric acid include acetic anhydride, acetic acid, aniline, carbon (wood charcoal & carbon black), paper, wood fiber, or sawdust.

            - Procedures involving heated perchloric acid, reactions involving dehydrating agents, or routine use of perchloric acid must be conducted in a perchloric acid fume hood equipped with a water wash-down system. The wash down system should be turned on immediately after perchloric acid has been heated in the hood or after general use of the fume hood. Step by step instructions should be written on how to operate the wash-down for perchloric acid hoods.
            - Tests shall be conducted for explosive perchlorates before any inspection, cleaning, maintenance, or other work performed on the exhaust system or hood interior.
            - Perchloric acid hoods are specifically designed for the use of perchloric acid and other material that can deposit shock sensitive crystalline materials in the hood and

exhaust system. Only those chemicals for which the hood is specifically designed should be used in a perchloric acid hood.

- In the event of exposure

    - In the event of skin contact, immediately wash with soap and water and remove contaminated clothing. Seek medical attention immediately. In case of eye contact, promptly wash with copious amounts of water for a minimum of 15 minutes (lifting upper and lower lids occasionally) and obtain medical attention. If perchloric acid is ingested, obtain medical attention immediately. If large amounts of this compound are inhaled, move the person to fresh air and seek medical attention at once.

    - In the event of any type of exposure to this chemical, contact Public Safety Dispatch at 2-2200 who will call an EMT and contact Environmental Safety Division. After any exposure, an incident/accident form should be filled out with Environmental Safety Division.

- Spills

    - Spill control materials should be available to control the release of perchloric acid. Appropriate protective equipment for clean-up should be worn (i.e., lab coats, protective gloves, protective rubber boots). Clean-up the spill according to established SOP.

    - Perchloric acid spilled on the floor or bench top represents a hazard since the evaporation of the spill may lead to the formation of more dangerous concentrations of the acid. It should **not** be mopped up, **nor** should it be soaked up with dry combustibles.

    - Remove all combustibles from the surrounding area (i.e., wood, paper, oils). A water spray may be used to help reduce vapors and keep the area wet. Measures should be taken to keep the material or spill area from drying. Neutralize the spill with a dilute solution of sodium hydroxide and then use absorbent material such as universal pads or absorbent clay to absorb it. Place the material in closed flammable waste disposal can.

    - The area of the spill should be thoroughly rinsed once again and tested for the presence of perchlorates. You may want to neutralize this area also.

- Hazardous waste disposal

    Excess perchloric acid and waste material containing perchloric acid should be placed in a glass reagent container and disposed of according to those procedures.

- Test procedure for perchlorates

    - Collect approximately 10-20 ml of wash water flushed from duct work of the perchloric acid hood and contaminated surfaces.
    - Add approximately 2-5 drops of 0.1% solution methylene blue in water.
    - If a violet precipitate forms perchlorates are present.
    - If perchlorates are present, flush the duct work with water until the test is negative.
    - Contact ESD if you have any questions.